Emissions of Volatile Organic Compounds from Northern Ecosystems: Potential Effects of Climatic Warming and Ozone Depletion.

Faubert, Patrick; Rinnan, Riikka; Tiiva, Paivi; Michelsen, Anders; Holopainen, Jarmo

Publication date:
2006

Document version
Publisher's PDF, also known as Version of record

Emissions of Volatile Organic Compounds from Northern Ecosystems: Potential Effects of Climatic Warming and Ozone Depletion

Patrick Faubert[1], Riikka Rinnan[1, 2] , Päivi Tiiva[1], Anders Michelsen[2], Jarmo Holopainen[1]

[1]Department of Ecology and Environmental Science,
University of Kuopio, P.O.Box 1627, 70211 Kuopio, Finland.
E-mail: patrick.faubert@uku.fi

[2]Department of Terrestrial Ecology, Institute of Biology,
University of Copenhagen, Øster Farimagsgade 2D, DK-1353 Copenhagen K, Denmark

Background

Climatic change scenarios predict that the Arctic will experience greater warming than other parts of the world. The high latitude ecosystems face also the effects of a more severe stratospheric ozone depletion than the lower latitudes. These changes will have a wide range of effects on arctic ecosystems such as the migration of the southern vegetation communities towards the north. Both environmental and vegetation changes are expected to change the VOC emission patterns of the arctic ecosystems.

Objectives

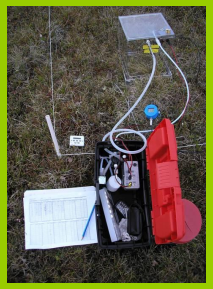
1-Increasing the understanding of the controls of VOC emissions from northern ecosystems under climate change and ozone depletion

2-Identifying and quantifying the VOC emissions (excluding isoprene) from the most important plant species in subarctic peatland and heath ecosystems

3-Elucidating how the quantity and quality of VOC emissions may change by future climatic warming and ozone depletion

4-Investigate the relationships between VOC, CO_2 and CH_4 emissions in the northern ecosystems

Field Measurement Techniques



•VOC emissions collected into Tenax/Carbopack adsorbent

•VOC measurements done with a dynamic chamber technique onto a metallic collar permanently inserted into the soil

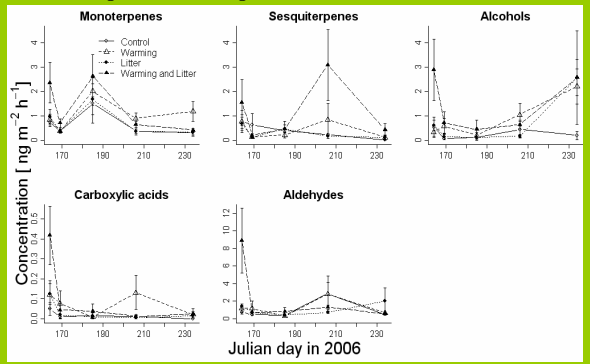
•Photosynthetically active radiation, air temperature and relative humidity monitored during the VOC collection

Climatic Warming

•Study site: Abisko, Northern Sweden (68°21'N, 18°49'E), wet dwarf shrub/graminoid heath
•Treatments: warming, mountain birch litter addition (90 g m^{-2}) and their combination, replicated six times in a factorial design
•Established in 1999

Warming by open-top greenhouses ***Mountain birch litter addition***

Preliminary results: The warming treatment significantly increased the emissions of monoterpenes, sesquiterpenes, alcohols and carboxylic acids. The litter treatment and its interaction with the warming did not induce significant effects.



Ozone Depletion

•Study site: Sodankylä, Northern Finland (67°22'N, 26°38'E), mesotrophic flark fen
•Treatment: 46% increase in UV-B radiation, simulating 20% ozone depletion, compared to control and UV-A control plots, each replicated 10 times
•Established in 2003

VOC sources: plant species vs. soil

Studied on the field and in growth chambers

•Study site: Abisko, birch forest
•Treatments: factorial removal of (1) *Vaccinium myrtillus* and *V. uliginosum*, (2) *Empetrum hermaphroditum* and (3) 50% of each. Replicated six times.
•Established in 2003

•Growth chambers: University of Kuopio
•Peatland microcosms
•Studies: effect of the water table level, microtopography on VOC emissions from plants species vs. soil
•In planning

Acknowledgements

•Research project funded by Emil Aaltonen Foundation, Finland